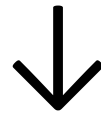# Collateral Crises

Gary Gorton, Yale and NBER

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Motivation 1

- How can a small shock cause a large crisis?

> 17 bps of realized losses on $1.9 trillion of AAA subprime issued in 2004, 2005, 2006, 2007 (as of Feb 2011).
>
> ↓
>
> ?
>
> Ben Bernanke: "13 of the most important financial institutions in the United States, 12 were at risk of failure within a period of a week or two."

Motivation 2

- Financial intermediation is about information.
    - Creation of info-insensitive debt for trading.
    - Screening borrowers.
- Proposed regulations presume transparency should be a goal.

> "By putting the transparency issue on the agenda . . . will lead to significant changes." Gordon Brown, 2008
>
> "We can't accept that this lack of transparency should jeopardize the growth we need." Nicolas Sarkozy, 2008
>
> "In our recovery package we put in new standards of accountability and transparency, which we hope will now apply." Nancy Pelosi, D-CA, 2009

Some Questions

- Why is there opacity to start with?

- What are the costs and benefits of information production and transparency in financial markets?

- How does information production affect business cycles and financial crises?

- Should policies aim to induce transparency?

Our Preliminary Answers

- In a world of collateralized short-term debt, it may **not** be optimal to produce information about the quality of collateral.
- Opacity, which makes it hard to distinguish good collateral from bad collateral has:
  - Benefits: **Ignorance-based Credit Boom** – Firms with bad collateral get loans that they otherwise would not.
  - Costs: **Fragility** – System very susceptible to small shocks.
- As "ignorant credit" grows, system becomes increasingly fragile.
- **Low probability events, tail events, are endogenous.**

Micro Foundations

Financial intermediation is about the provision of trading securities: money.

- Gorton and Pennacchi (1990): banks exist to create information-insensitive debt (riskless).

    - Agents trade; need a security to protect against adverse selection.

    - Liquidity$\rightarrow$information-insensitivity; but debt exogenous.

- Dang, Gorton, Holmström (2010): debt is the optimal trading security because it is information-insensitive (not just riskless).

    - Crisis$\rightarrow$fear of adverse selection reduces amount traded (and hence welfare); info-insensitive->info-sensitive.

Based on/Inspired by Empirical Observations

- <u>Crises frequent</u>: 124 since 1970.

- <u>Credit boom</u> precedes crisis.

- Panic occurs <u>at/near business cycle peak</u>.

- Financial crises have <u>bank debt</u> as the common feature**.**

- Creation of bank trading securities requires "backing <u>collateral</u>"—

    - Free Banking Era (1837-1863): private money issuance required backing of state bonds;

    - Demand deposits: require backing of diversified loan portfolios;

    - Repo: backed by specific bond; depositor takes physical possession of the collateral.

    - ABCP: requires backing of high-grade ABS;

    - CP: only high-grade issuers.

Model

- Two overlapping generations every period.

    - Young/Households: Endowment and no labor.

    - Old/Firms: Labor but no endowment.

- Two goods that can be used to consume or produce.

    - Numeraire (K): Perishable and reproducible.

    - Land (X): Non-perishable and non-reproducible.

Land Collateral

- Land type unknown without info production.

- Good land: Generates C units of numeraire (only once).

- Bad land: Generates 0 units of numeraire (only once).

- Each unit of land has a common belief p of being good.

$$X = \begin{cases} C & \text{with probability p} \\ 0 & \text{with probability } (1-p) \end{cases}.$$

- Learning whether a unit of land if good or bad costs γ in terms of K.

Firms

- Continuum of mass 1 of risk neutral individuals/firms (old generation).
- When old each has entrepreneurial ideas L* (no disutility) and no K.
- A firm is a combination of labor, L*, a unit of land X, and numeraire K ("capital"), to produce more numeraire:

$$Y = \begin{cases} A \min\{K, L\} & \text{with probability } q \\ 0 & \text{with probability } (1-q) \end{cases}$$

where A>1.

- Firms need to borrow K to produce. Optimal K*=L*.
- Production is efficient, i.e., qA>1.

Households

- Continuum of mass 1 of risk neutral households (young generation).

- Each is born endowed with $\overline{K} > K^*$ of numeraire good and no L*.

- They can lend K to firms and buy land X from firms.

Market for land

- At the end of a period:
  - Match of a household with a firm (young with old).
  - Negotiation power to the buyer (take-it-or-leave it offer).
  - Price of land is pC.

Lending market

- At the beginning of the period:
  - The output of firms is non-contractible.
  - Firms can post a fraction x of land as collateral.
  - Match of a household and a firm.
  - Negotiation power to the borrower.
  - Assume C>K*.

Aggregate Consumption

- Consumption in period t of:
    - A young/household lending to a firm of quality p and buying land for pC:

$$\bar{K} - K(p) + E(repay|p) - pC$$

    - An old/firm with land of quality p:

$$E(Y|p) - E(repay|p) + pC$$

- Aggregate consumption in period t:

$$W_t = \bar{K} + \int_0^1 [E(Y|p) - K(p)]f(p)dp.$$

- First Best aggregate consumption: $W^* = \bar{K} + K^*(qA - 1)$.

Information-Sensitive Debt

- Firms and lenders learn the true value of collateral.

- Lenders set R_{IS} and x to break even:

$$p(qR_{IS} + (1-q)xC - K) = \gamma \Rightarrow R_{IS} = \frac{\gamma + pK - (1-q)pxC}{pq}.$$

- Firms borrows rather than sell land if:

$$pK^*(qA - 1) \geq \gamma, i.e., p \geq \frac{\gamma}{K^*(qA-1)}.$$

- Expected profit:

$$E(\pi|p, IS) = \begin{cases} pK^*(qA - 1) - \gamma + pC \ if \ p \geq \dfrac{\gamma}{K^*(qA - 1)} \\ pC \qquad\qquad\qquad\qquad\quad if \ p < \dfrac{\gamma}{K^*(qA - 1)} \end{cases}$$

Information Insensitive Debt

- Neither firms nor lenders know the true value of collateral.

- Firms with low p are constrained. Might want to have info produced.

- Lenders set R_{II} and x to break even:

$$pR_{II} + (1 - q)pxC = K \Longrightarrow R_{II} = \frac{K - (1 - q)pxC}{q}$$

Such that $R_{II} = pxC$. Then $x = \frac{K}{pC} \leq 1$.

- Loans do not trigger information acquisition if:

$p(qR_{II} + (1 - q)xC - K) < \gamma \Rightarrow (1 - p)(1 - q)xC < \gamma$; if this is
binding then: $K \leq \frac{\gamma}{(1-p)(1-q)}$.

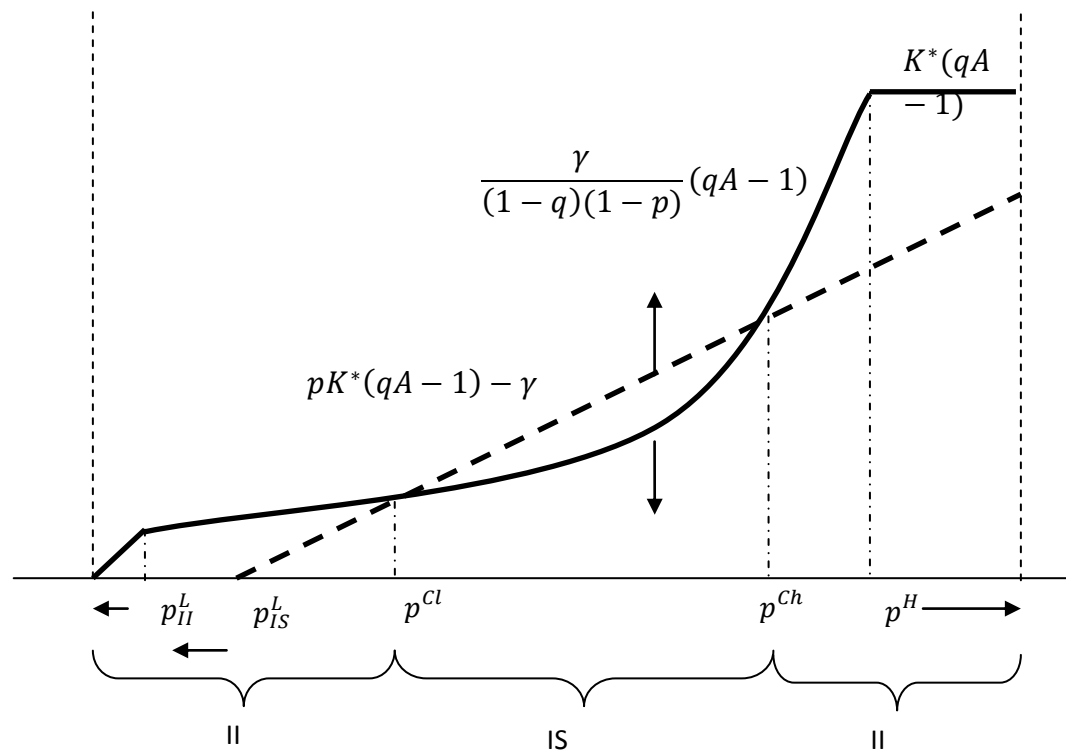- Expected profit: q(AK − R + pC)+(1-q)0, so:

$$
E(\pi|p, II) = \begin{cases} K^*(qA - 1) + pC & if \ K^* \leq \dfrac{\gamma}{(1-p)} \\[2em] \dfrac{\gamma}{(1-p)(1-q)}(qA - 1) + pC & if \ K^* > \dfrac{\gamma}{(1-p)} \\[2em] pC & if \ C < \dfrac{\gamma}{(1-p)} \end{cases}
$$

- First kink is generated at the point at which the constraint to avoid info production is binding.

- Second kink generated by the constraint that $x_{II} \leq 1$, below which the firm is able to borrow up to the expected value of the collateral, pC, without triggering info production.
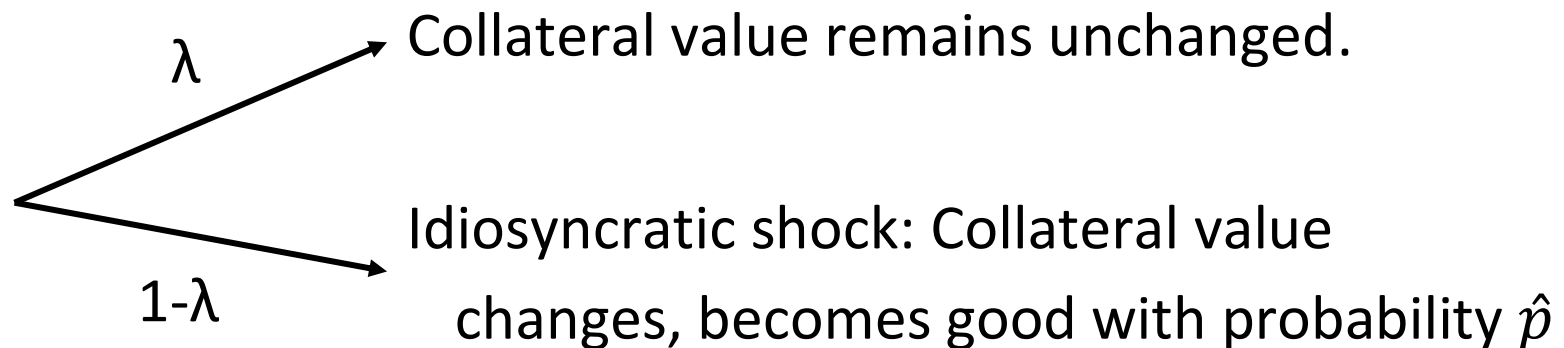
Optimal Debt

• Info-sensitivity of debt depends on beliefs, p.

The figure shows the horizontal axis with marked points p_{II}^L, p_{IS}^L, p^{Cl}, p^{Ch}, p^H (left and right arrows indicating direction). Curves labeled $K^*(qA - 1)$, $\dfrac{\gamma}{(1-q)(1-p)}(qA - 1)$, and $pK^*(qA - 1) - \gamma$. Brackets below mark regions II, IS, II.

• Arrows show direction of movement as γ is reduced. IS region grows.

Multiple Periods

- Evolution of collateral value:

λ → Collateral value remains unchanged.

$1\text{-}\lambda$ → Idiosyncratic shock: Collateral value
changes, becomes good with probability $\hat{p}$

- Each collateral has one of three possible beliefs:
    - $p = 0$, if information is that the collateral is bad and no shock.
    - $p = 1$, if information is that the collateral is good and no shock.
    - $p = \hat{p}$, if no information after the last shock.
- Assume that at t=0 all collateral qualities are known.
- Assume (for now) no aggregate shock.

Aggregate Shocks

- Negative shock: transforms a fraction $(1 - \eta)$ of good collateral into bad collateral.

- Positive shock: transforms α of bad collateral into good collateral.

- Shock observable, but which collateral changes quality is not observable.

- Example, negative shock:
    - Collateral with $p = 1$ becomes $p' = \eta$ after the shock.
    - Collateral with $p = \hat{p}$ becomes $p' = \eta\hat{p}$ after shock.
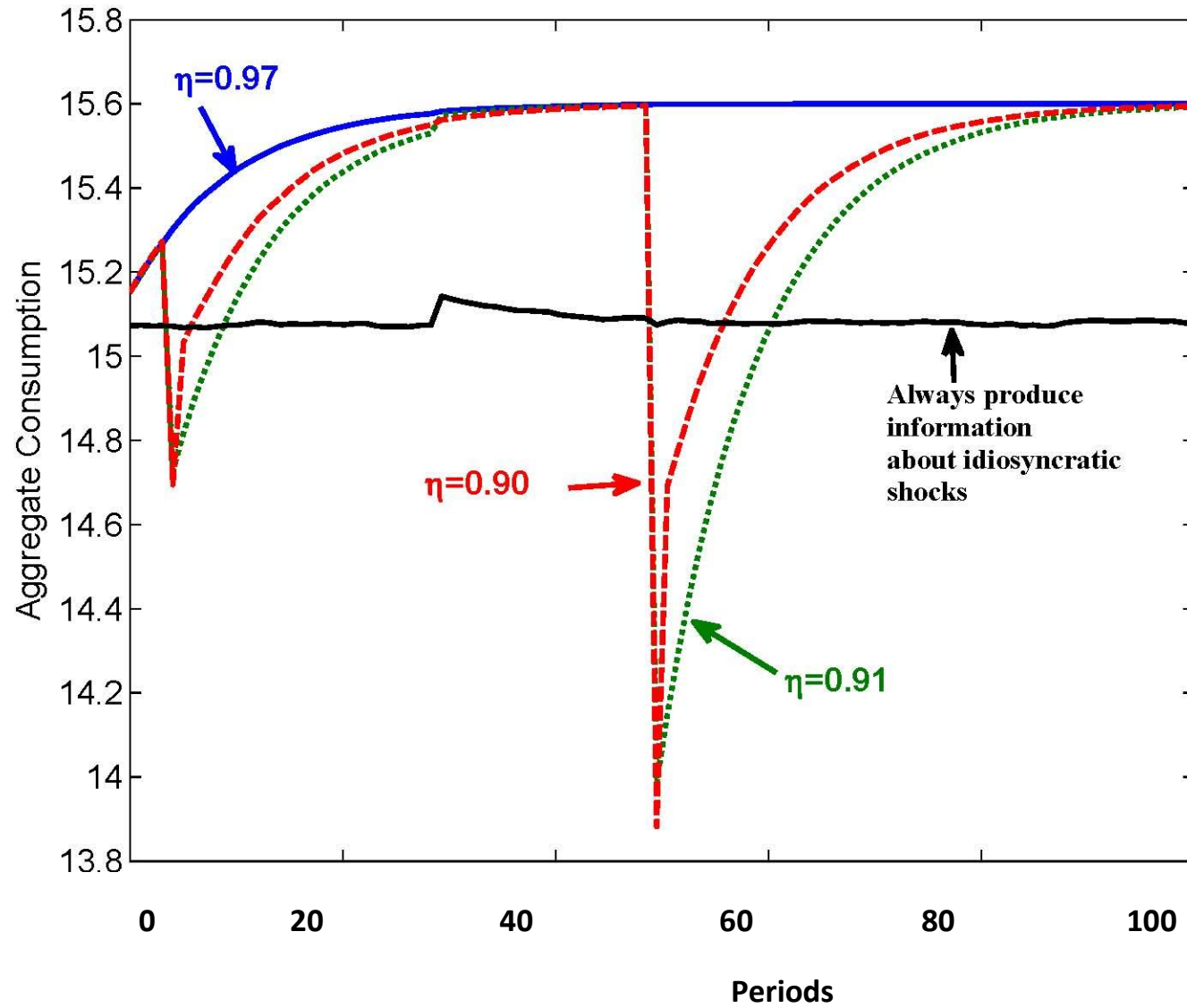   - Collateral with $p = 0$ remains $p' = 0$ after shock.

Numerical Simulations

- Pick parameter values for: λ, q, A, $\overline{K}$, L*, K*, γ, C, β.

- Parameters are such that $\hat{p} > p^H$.

- Simulate for 100 periods.

- Assume:
    - Transitory negative shock in periods 5 and 50.
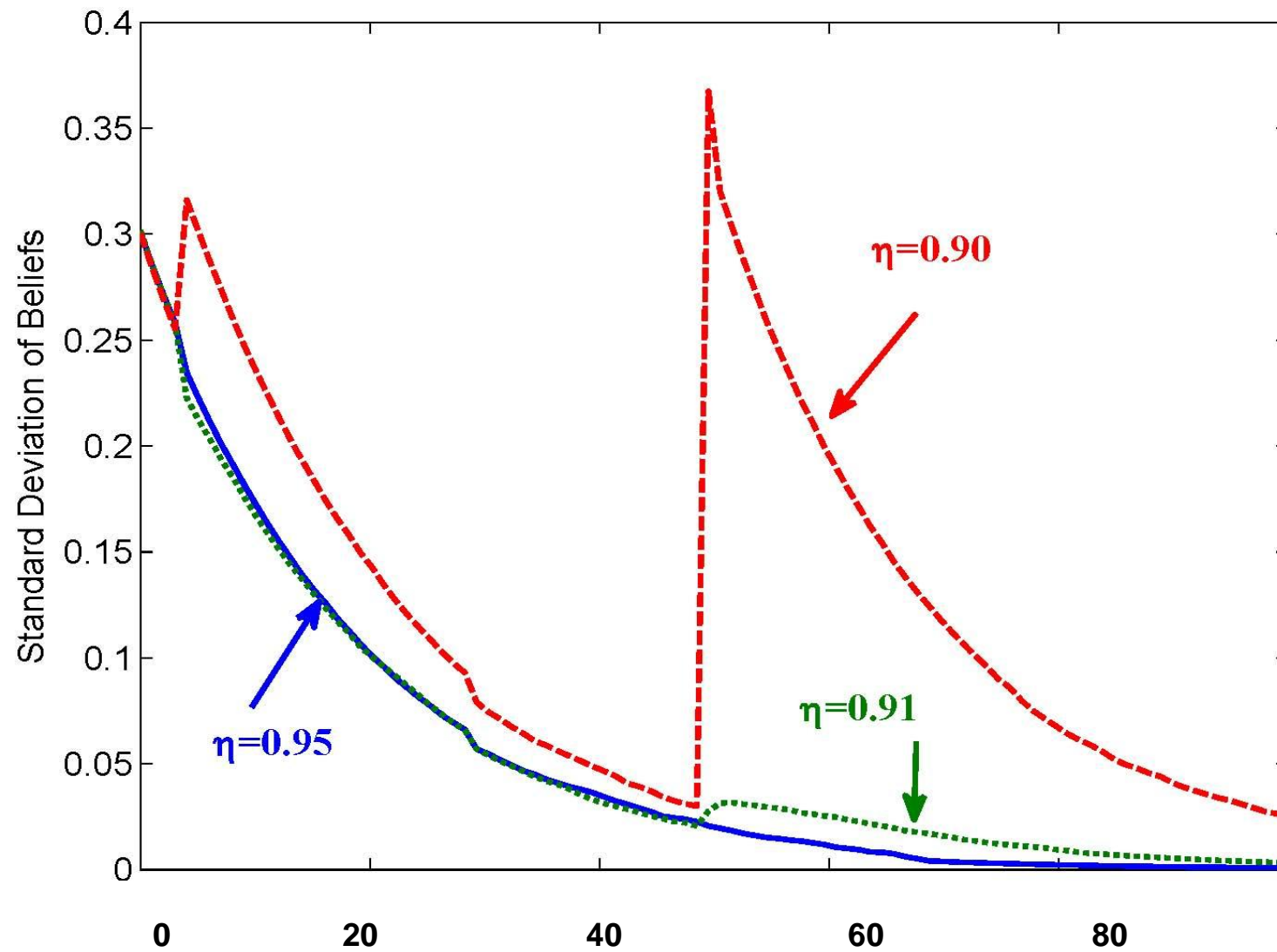   - Transitory positive shock in period 30.

Average Quality of Collateral
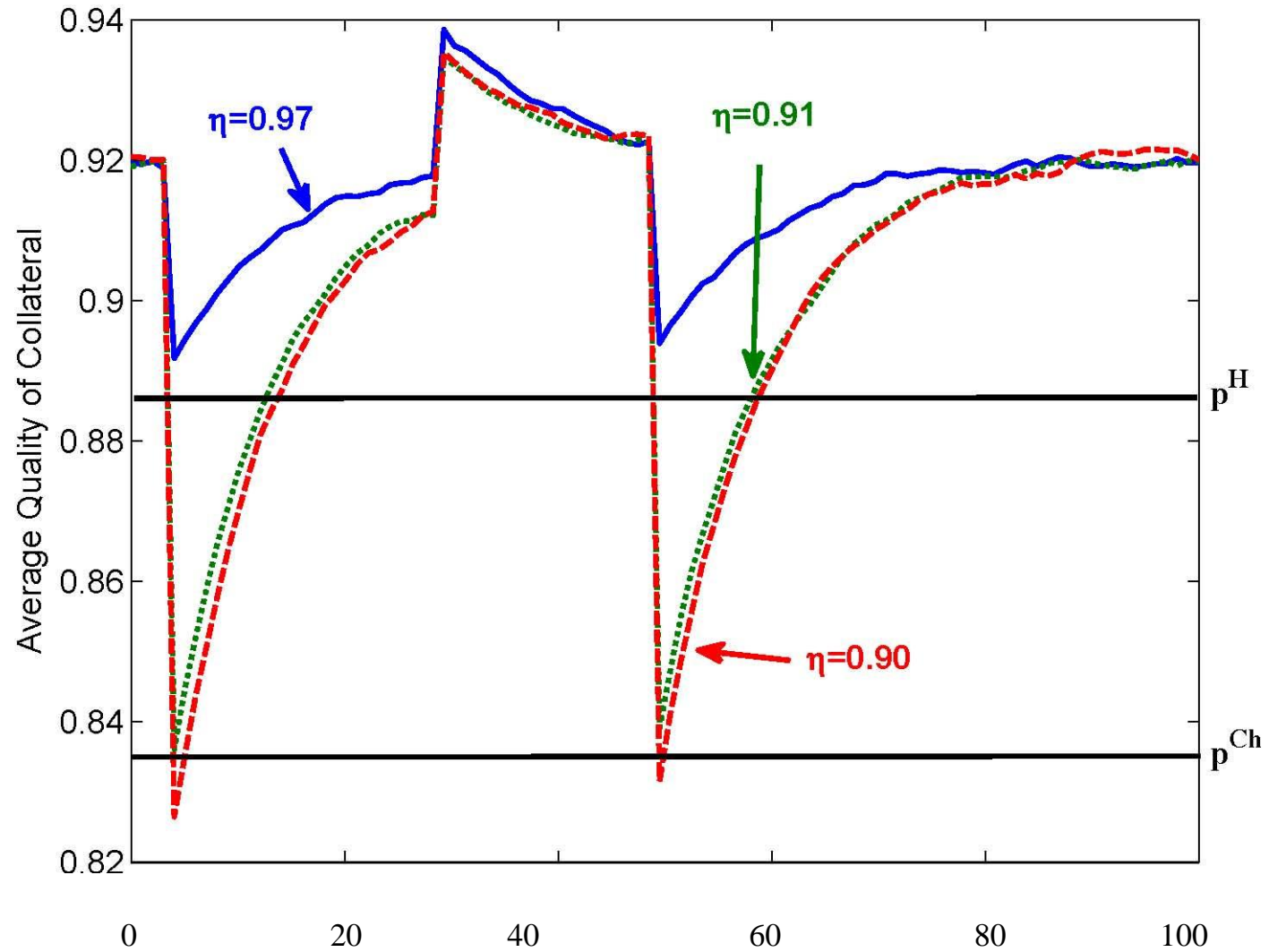
Aggregate Consumption (Welfare)

Standard Deviation of Belief Distribution

Policy Implications

- Social planner maximizes discounted consumption of all generations.

- <u>Proposition</u>: The possibility of a negative aggregate shock does not always justify acquiring information and reducing current output to insure against potential future reductions in output.

Final Comments

- Information-insensitive debt may be socially desirable, but it is vulnerable to a sudden loss of confidence in its insensitiveness.
- Macroeconomic implications:
  - Leads to credit booms and increased fragility.
  - The switch from info-insensitive to info-sensitive regimes causes a loss of welfare.
  - Posterior recovery depends on whether info is replenished or not.
  - Volatility of beliefs leads to volatility of production and consumption.